Widespread PFAS groundwater contamination via industrial airborne emission

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Plastics manufacturing and industrial coating operations in southwestern Vermont, and eastern New York State, USA has caused widespread contamination of groundwater by per- and polyfluoroalkyl substances (PFAS). Perfluorooctanoic acid (PFOA) and other PFAS aerosols vented during manufacturing were deposited on land over at least 250 km^2, and have now infiltrated to surficial and bedrock aquifers. Over 1,500 private wells and a public water system serving 4,500 residents have been contaminated above Vermont's dinking water standard of 20 ppt PFOA.

We sampled undisturbed forest soils on preserved land in order to study the distribution of air-deposited PFOA while isolating possible PFOA point-sources. Our results indicate that air emission of PFOA caused groundwater contamination at distances >15 km downwind from and >700 m elevation above sources. Soil sampling outside of the air-deposition plume suggest that “background” dry soil concentration of PFOA in the northeastern US is ~0.6 ppb in areas remote from locations of industrial PFOA use, and ~1.1 ppb in regions within 30 km of industrial PFOA use.

Groundwater sampling and analysis for major and trace-element geochemistry, stable isotopes, and age-dating tracers indicates that local variation in PFOA contamination levels are primarily due to fault- and fracture-controlled flow-path differences. Parts of the bedrock aquifer that receive recharge directly from local, overlying unconsolidated materials are highly contaminated, while nearby wells that intersect faults and fractures with more distant flow paths may be uncontaminated by PFAS. Initial results also suggest that longer residence time in the unconsolidated aquifer is correlated with higher levels of PFAS contamination in the underlying fractured rock aquifer.